Weak Lensing Update

Christopher Hirata
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With much assistance from
B. Rowe, the HLS subgroup, and Project Office

Strategy

- Initially considered 3 filters across 1—2 μm bandpass
- Require
  - Shape measurements in at least 2 bands
  - Coverage for photo-z's (close gap between WFIRST + LSST).
- Sampling considerations forced shape measurement to the redder bands (F2+F3). From B. Rowe simulations:
  - 1.5 m obscured required 6—7 positions
  - 1.3 m unobscured required 5 positions
- F1 still needed for photo-z's; required depth TBD

Current Version of ETC (v6)

- Diffraction from circular/annular pupil
- Fitting function for aberrations (NEW)
- Convolution with exponential profile
- Galaxy population from Cosmos Mock Catalog (Jouvel et al 2009)
- Estimation of ellipticity error using Fisher integral
- Currently demand resolved galaxy (R>0.4) + ellipticity error σ_e<0.2 per component per filter

Quick Comparison

- Assumed 71 nm rms wave front error (diffraction limited @ 1 μm)
- 1.5 m obscured JDEMΩ/no pupil mask:
  - EE50: 213 mas (F1) 248 mas (F2) 296 mas (F3)
- 1.3 m unosbcured WFIRST 1c/no pupil mask:
  - EE50: 156 mas (F1) 168 mas (F2) 188 mas (F3)
- ~~1.3~~ 1.249 m unosbcured WFIRST 1c/with mask:
  - EE50: 159 mas (F1) 173 mas (F2) 194 mas (F3)
- The unobscured options remain superior even if we turn off the aberrations in the obscured option.

Galaxy Yields

- Computations @ β=45°, ε=115°, E(B−V)=0.1
- WFIRST 1c (with pupil mask), 6×150 s
  - Shapes to ~23.9 AB (S/N=17 per filter @ r_{eff}=0.3”)
  - F2: n = 32.3/am^2, n_{eff} = 29.2/am^2.
  - F3: n = 34.7/am^2, n_{eff} = 31.6/am^2.
  - 5×180 s does slightly better.
- JDEMΩ, 6×150 s
  - F2: n = 22.0/am^2, n_{eff} = 20.0/am^2 [29.2/am^2 in 6×480 s.]
  - F3: n = 19.8/am^2, n_{eff} = 18.2/am^2.
- This is due both to requiring galaxies to be resolved and the higher ellipticity noise in the obscured configuration.

Advantages of Unobscured Option

- Statistics: higher n_{eff} at fixed time or shorter time at fixed n_{eff}.
- Eliminate diffraction spikes
  - Improved tolerance to rolls
  - Reduce coverage losses
- Weakly undersampled data guarantees that even in F2 there are some unaliased Fourier modes.
  - Redundant information between exposures helps control systematics and lower data processing risks
  - e.g. sky subtraction & defect detection possible with algorithms being used in ongoing WL analyses (E. Huff/LBL)

Pixel Scales

- JDEMΩ imager has 0.18”/pix.
  - We have guidance from Astro2010 to not significantly increase this.
  - This scale was kept in previous charts.
  - WFIRST 1c option has the same imager scale.
- B. Rowe is evaluating options from 0.16—0.22”/pix.
  - At 0.16”/pix, the 1.5 m option can take 5 random dithers in F2/F3. (Also only weakly undersampled.)
  - At 0.22”/pix, 1.3 m is strongly undersampled in F2; ≥6 dither positions required, 8 for 1.5 m. This will increase coverage rate but is much higher risk for WL.